The relationship between child's play and scientific exploration

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Laura Schulz, primary investigator in the Early Childhood Cognition Lab in the Department of Brain and Cognitive Sciences, works with Madeline Wilson, who is wearing a backpack outfitted with a microphone that records her speech. Credit: M. Scott Brauer

Laura Schulz, an associate professor of brain and cognitive sciences at

MIT, has always been interested in learning and education. At the age of 6, she tried teaching her 3-year-old sister to read, an effort that met with limited success.

"She did eventually learn to read, wrote a book, and is now even a book reviewer, but I think I had very little to do with it," Schulz recalls. "It went swimmingly at the letter A, and by the time we got to the letter B she wanted to go play in the sandbox, so that was the end of that."

Schulz has devoted her academic career to investigating how learning takes place during early childhood. Starting in infancy, children are quickly able to learn a great deal about how the world works, based on a very limited amount of evidence.

Schulz's research, much of which she does at a "Play Lab" at Boston Children's Museum, reveals that children, and even babies, inherently use many of the same strategies employed in the scientific method—a systematic process of forming hypotheses and testing them based on observed evidence.

"All of these abilities that we think of as scientific abilities emerged because of the hardest problem of early childhood learning, which is how to get accurate abstract representations from sparse, noisy data," she says.

How learning happens

Growing up in Shaker Heights, Ohio, Schulz considered herself to be mostly a "humanities girl," though as a middle school student she did participate in a "future scientists" program at the Cleveland Museum of Natural History. She also spent a lot of time tutoring younger students. "My mom's a teacher and my dad was on the school board, so education was always something that interested me," she says.

While studying philosophy at the University of Michigan, Schulz volunteered in an adult-literacy program, where she struggled with how to help a smart young woman with dyslexia. "I asked what to do and was told to be patient and understanding, and I said, 'Well, I'm going to be patient and understanding, but what is actually going to help here?' I remember thinking there have got to be better answers out there," she says.

After college, Schulz spent several years working a series of seasonal jobs: She taught science at outdoor schools in California and Oregon, worked at a summer program for inner-city children from Washington, D.C., and started an after-school program for middle school girls.

"This was all great work, but it's vastly underpaid and has no health benefits, so eventually other people, especially my father, started asking why I wasn't going to graduate school. It became harder and harder to answer that question," she recalls.

She thought about studying education and getting certified as a teacher, but found herself more drawn to studying how learning takes place. There were no such graduate programs in Portland, Ore., where she was living at the time with her partner and children, so she ended up commuting to the Bay Area by plane, spending three days a week there, for the first two years of her graduate program at the University of California at Berkeley.

Her PhD research, done with Berkeley psychologist Alison Gopnik, focused on causal learning in early childhood. The lab was investigating the theory that children's representations of the world resemble scientific theories that allow them to form categories and identify relationships between different things. Specifically, Schulz studied causal inferences—the process of drawing conclusions based on observed causes and effects.

While Schulz was finishing her PhD, her partner sold her business and they decided to think about moving away from Portland. Boston was one of a handful of cities that seemed appealing, so Schulz applied for and was offered a position at MIT.

Exploring the world

After coming to MIT, Schulz became interested not only in how children learn from observed evidence, but also how they generate evidence through exploration. She has found that many of the components of the scientific method—isolating variables, recognizing when evidence is confounded, positing unobserved variables to explain novel events—are in fact core to children's early cognition.

In one recent study, she investigated infants' abilities to determine, from very sparse evidence, the properties of sets of objects. In the study, babies watched as an experimenter pulled a series of three balls, all blue, from a box of balls. Each ball squeaked when the experimenter squeezed it. The babies were then handed a yellow ball from the box.

When most of the balls in the box were blue, the babies squeezed the yellow ball, suggesting that they generalized the squeaking to the entire box of balls. However, if the balls in the box were mostly yellow, the babies were much less likely to try to squeeze them, showing they believed that the blue, squeaking balls were a rare exception.

Another recent experiment explored the value of offering lessons versus allowing children to explore on their own. In that study, Schulz found that children who were shown how to make a toy squeak were less likely to discover the toy's other features than children who were simply given the toy with no instruction.

"There's a tradeoff of instruction versus exploration," she says. "If I instruct you more, you will explore less, because you assume that if other things were true, I would have demonstrated them."

Although Schulz hopes that someday her work will lead to development of new education strategies, that is more of a long-term goal.

"We're just trying to understand what fundamental principles govern learning and how children represent information and how they make inferences. I don't think that we have yet the kinds of things where we can say, 'Because of this, you, the classroom teacher, should do this,'" she says. "It really is basic science."

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